Reducing Costs in Thermoplastic Compounds Using Process Additives

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STRUKTOL COMPANY OF AMERICA:

- Member of the Schill & Seilacher family of companies
- Manufacturing in:
  - Stow, OH USA
  - Hamburg, Germany
  - Böblingen, Germany
  - Pirna, Germany
- Leading supplier of additives to the global polymer industry
- Leader in technical solutions for processors
- Experience in all types of compounding and process systems

CURRENT INDUSTRY ECONOMICS:

- Polymer prices are unstable – no end in sight
- Other formulation ingredient prices are increasing
- Energy costs are variable at best
- Transportation costs are increasing
- Global competitive pressures are increasing
- Price increases difficult to push through and sustain

Profitability is being hurt

CURRENT INDUSTRY TECHNOLOGY TRENDS:

- More highly engineered formulations
- Growing focus on field-performance enhancers
  - e.g., Coupling agents, UV Stabilizers, etc., flame retardants
- End-use properties maximized

All of these items can lead to increased raw material costs for the processor…

How can processors/manufacturers maximize profitability in this kind of market environment?

METHODS OF REDUCING PRODUCTION COSTS:

- Direct reduction of currently used raw material prices
- Substitution of lower priced raw materials for higher priced ones
- Increased throughput rates of finished product

For this presentation we analyzed in detail each of these options as to their effect on manufactured part cost. We will compare and contrast the methods and present conclusions about the most effective means of cost reduction based on:

1. Burden of work for the manufacturer
2. Ease of implementation
3. Effect on manufacturing and part performance
4. Overall cost reduction

REDUCTION OF RAW MATERIAL PRICES:

Options:

- Supplier juggling
- Acceptance of wider specification products
- Using less of or lesser engineered formulation ingredients

Potential Problems:

- On-time supply issues
- Changes in part physical properties
- Processing difficulties
- Processing variability

Burden of Work =	***High***
Ease of Implement =	***Med***
Effect on Part =	***Low - High***
Cost Reduction =	***???***

FORMULATION SUBSTITUTION:

Options:

- Use of higher levels of regrind
- Use of higher levels of lower cost ingredients
  - e.g., adding more filler in place of expensive polymer
- Reduction/elimination of engineered additives
  - e.g., lubricants, coupling agents, stabilizers, antimicrobials, etc.

Potential Problems:

- Processing difficulties / variability
- Product performance variability
- Product physical property limits

Burden of Work =	***Low - Med***
Ease of Implement =	***Med***
Effect on Part =	***Med - High***
Cost Reduction =	***???***

INCREASED THROUGHPUT RATES:

Options:

- Addition of compounding equipment to existing facility
- Increased screw speeds (if available)
- Optimized lubricant processing package

Potential Problems:

- Downstream cooling capacity
- Increased labor requirements
- Difficult to mandate and control

Burden of Work =	***Med - High***
Ease of Implement =	***High***
Effect on Part =	***Low***
Cost Reduction =	***???***

MEASURING PRODUCTION COSTS:

- Fixed costs including:
  - Plant and facilities investment and overhead
  - Labor
  - Depreciation
  - Taxes and Insurance
- Variable costs including
  - Raw materials
  - Utilities

We can measure costs focusing only on Variable Cost changes or we can include both Fixed and Variable in the analysis. For this presentation we will include both.

METHODOLOGY:

- Generic analysis of a fictional thermoplastic compounding plant producing filled compound
- Variables analyzed:
  1. *Raw material costs*
  2. *Scrap rate variation*
  3. *Raw material ratio variation*
  4. *Raw material substitutions*
  5. *Throughput rate variation*
- Fixed items include:
  1. *Initial investment $*
  2. *Total machine run time, hrs.*
  3. *Labor costs and rates*

PREMISE AND BASE INFORMATION:

- Highly filled WPC compound based on HDPE
- Plant:
  1. *6 – twin screw compounding extruders w/downstream*
  2. *Full raw material handling, pre-blending system*
  3. *Total plant investment $7 million*
  4. *Labor rate of $16/hour fully loaded*
  5. *Location: Midwest USA*
- Base scrap rate of 10%
- Actual annual actual run time of 7200 hours
- Base total output rate of 6000 lbs. per hour
- Annual total capacity with base formula 43.2 million pounds

  - Prime product capacity of 38.9 million pounds

BASE FORMULATION:

INGREDIENT	LEVEL, %	PRICE, $/#	NOTES
Pine wood flour	60.0	0.07	Variable
Virgin Wide-Spec HDPE	29.0	0.60	
Talc	3.0	0.15	Variable
Color Concentrate	2.0	1.50	
Lubricant Package	4.0	0.75	Variable
Antimicrobial	2.0	1.50	Variable

Other optional materials evaluated:

- Coupling agents, UV Stabilizers, Antioxidants
- If you use a hardwood flour you may need a tannin stain inhibitor

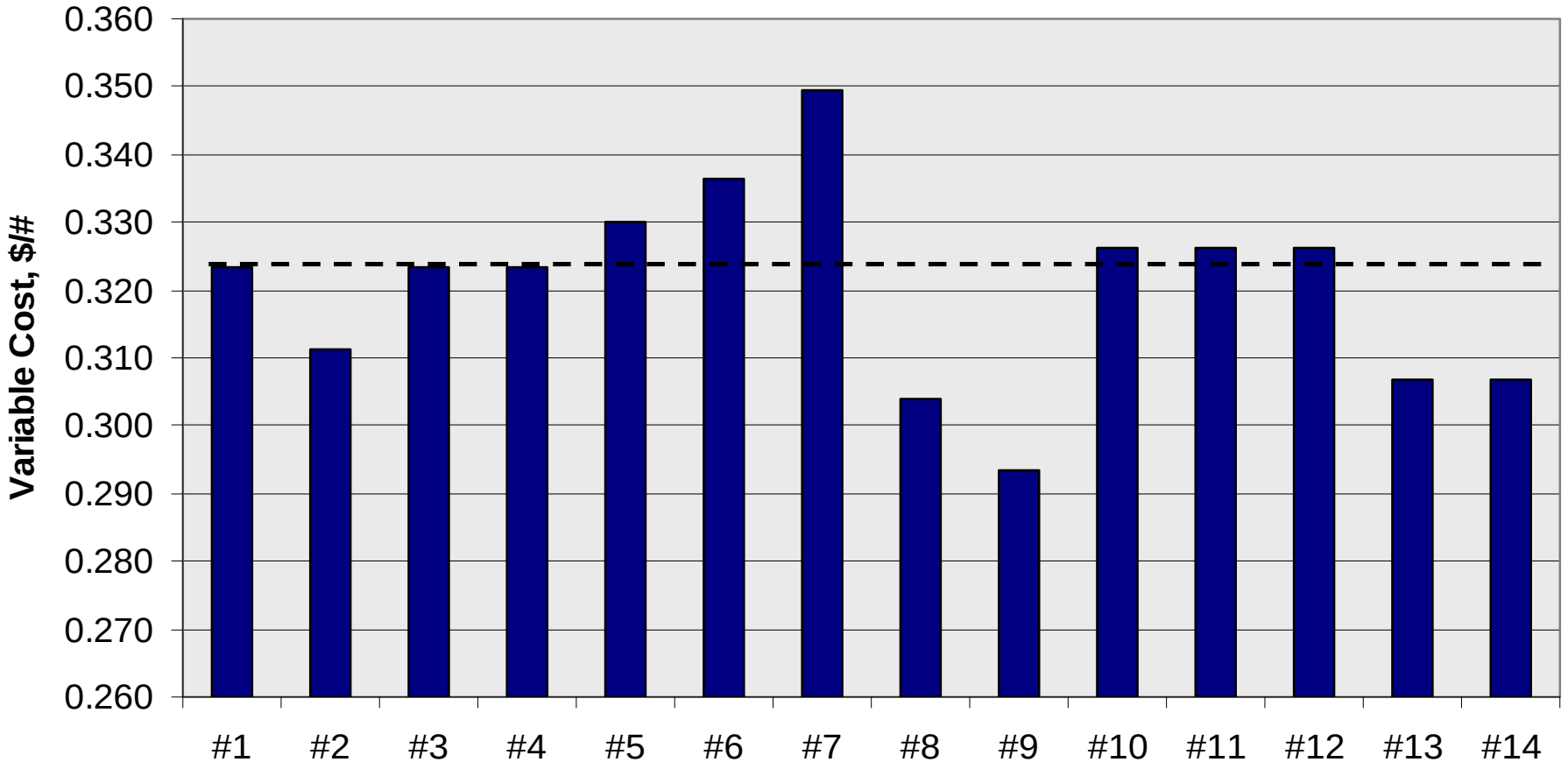
MEASUREMENTS:

- Variable costs and changes
- Fixed costs and changes
- Total part fabrication costs and changes
- Capacity gains
- Time savings

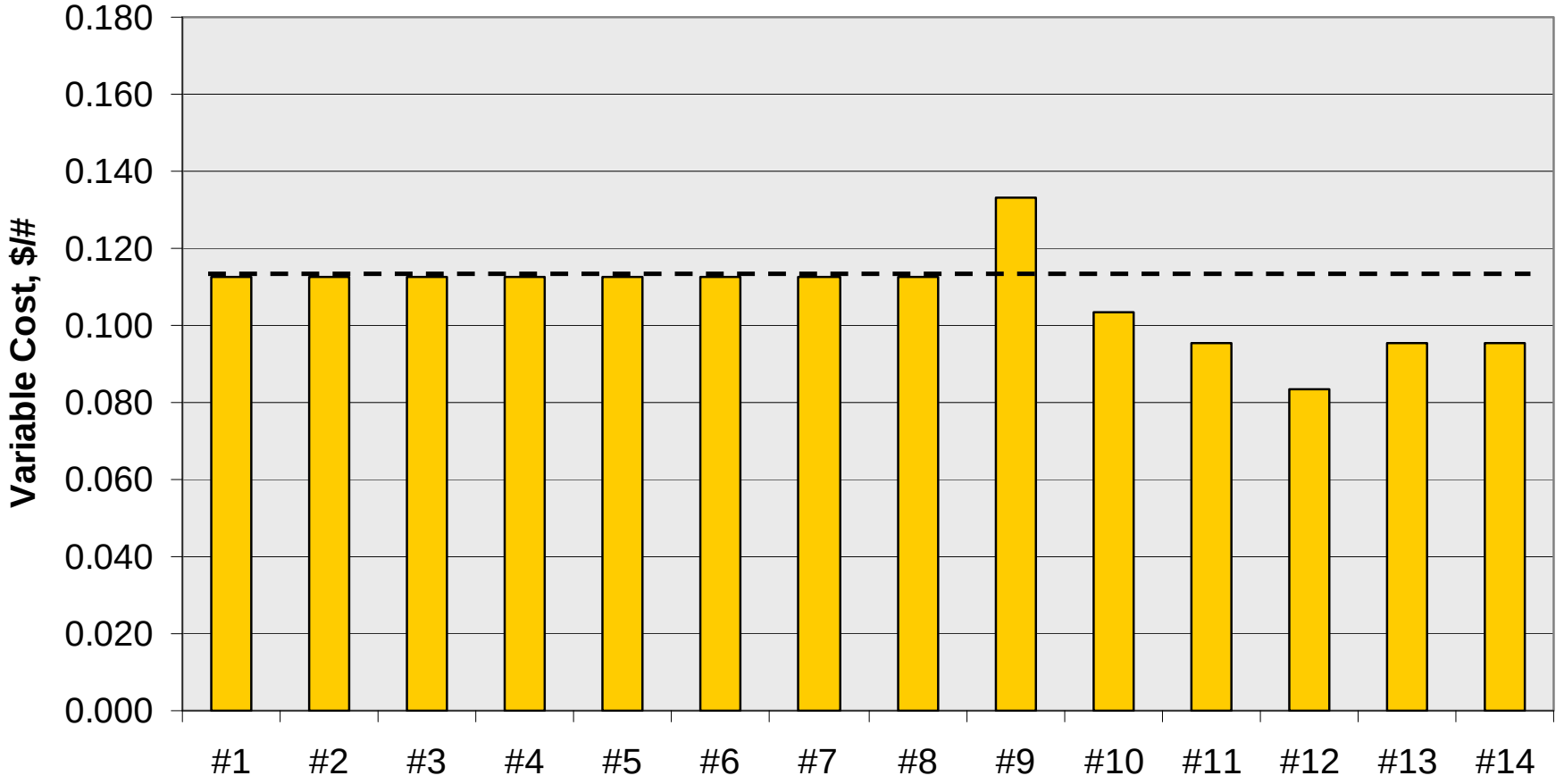
VARIABLE MODEL DESCRIPTIONS:

Model #	Formula	Variables
1	Base	Control
2	Base	Lower price of all raw materials
3	Base	Lower scrap rate – 7%
4	Base	Lower scrap rate – 5%
5	Base	Addition of regrind at 5%
6	Base	Addition of regrind at 10%
7	Base	Addition of regrind at 20%
8	Base	Use of higher wood fiber and talc loadings
9	Base	Elimination of antimicrobial and use of less lube
10	New Lube	Output rate increase of 10%
11	New Lube	Output rate increase of 20%
12	New Lube	Output rate increase of 20%
13	New Lube	Rate increase of 20% with higher filler loading
14	New Lube	Rate increase of 20% with higher filler, 5% scrap

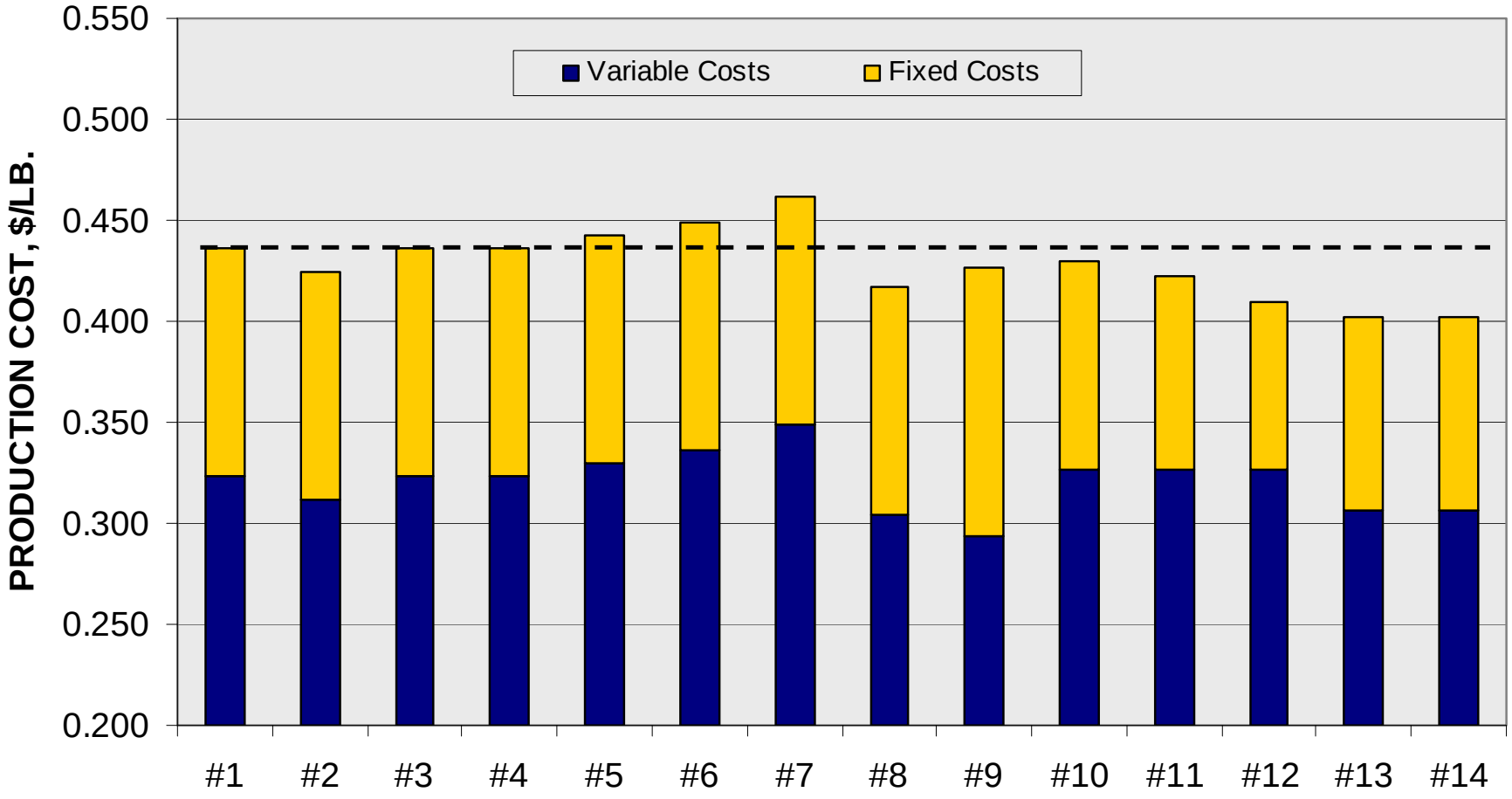
EFFECT OF VARIABLES ON VARIABLE PRODUCTION COSTS
Raw Materials and Utilities



EFFECT OF VARIABLES ON FIXED PRODUCTION COSTS
Labor, Overhead, Processing

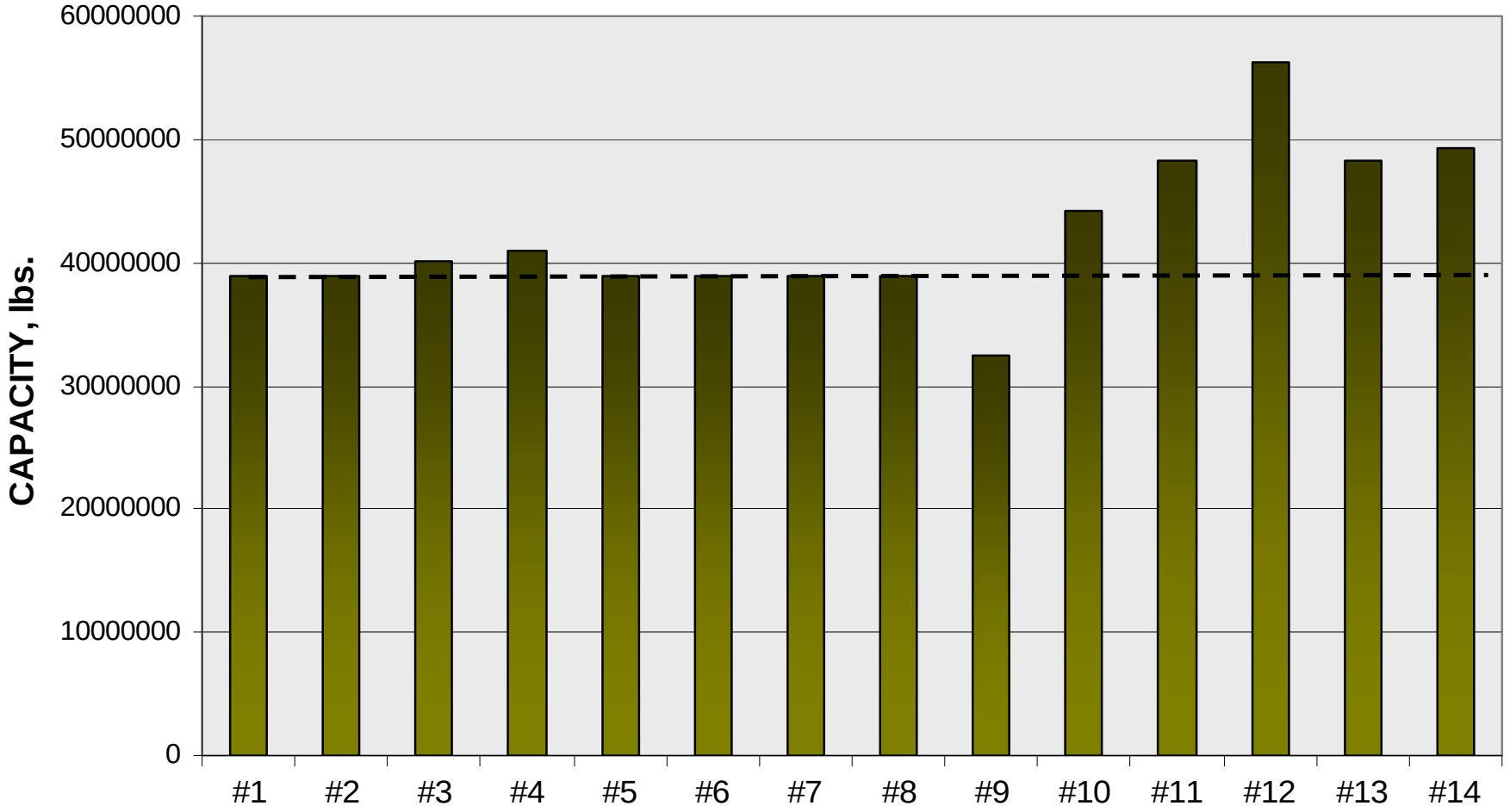


EFFECT OF VARIABLES ON PRODUCTION COSTS
Variable + Fixed Costs

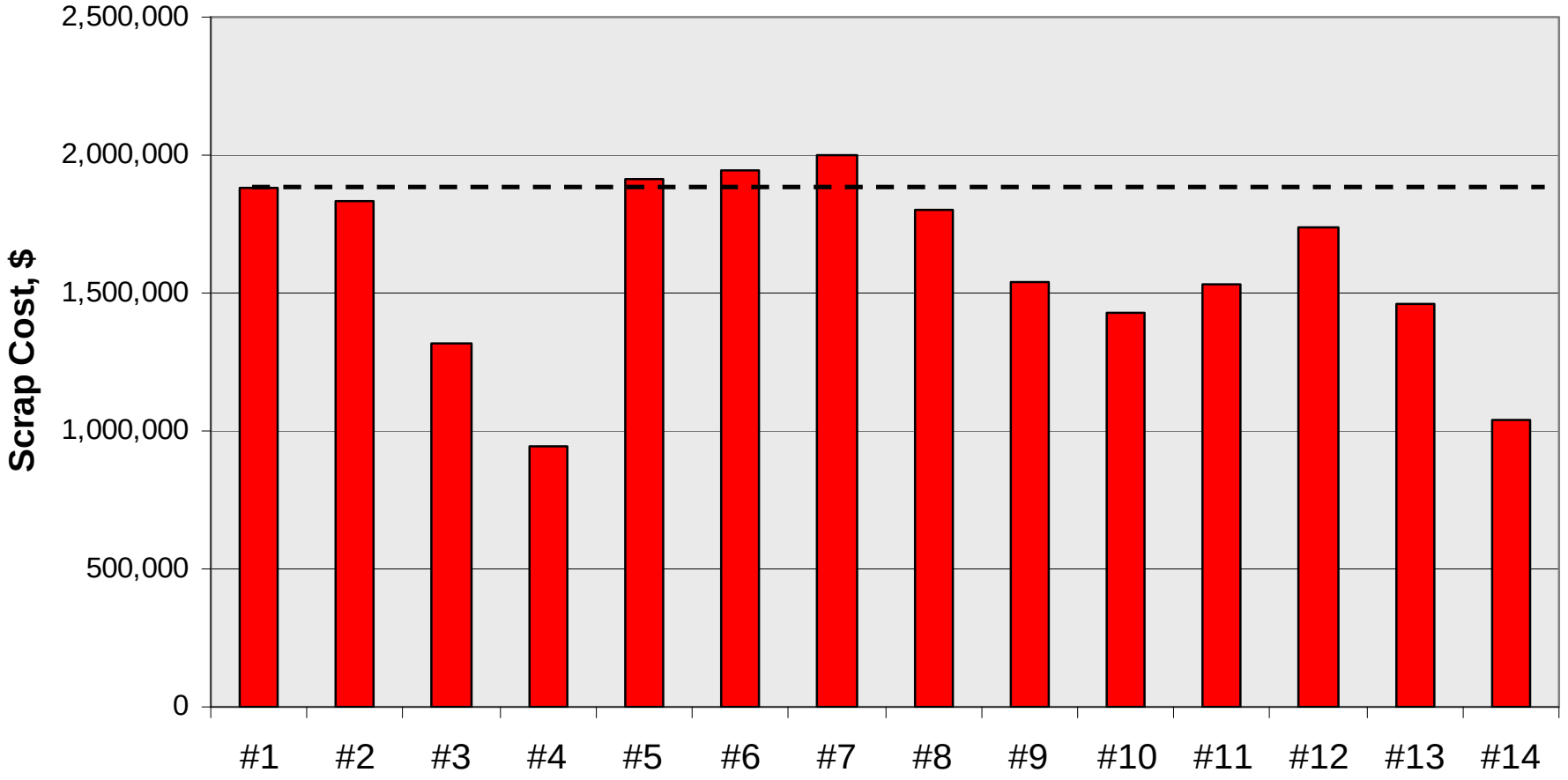


EFFECT OF VARIABLES ON PRIME GRADE CAPACITY

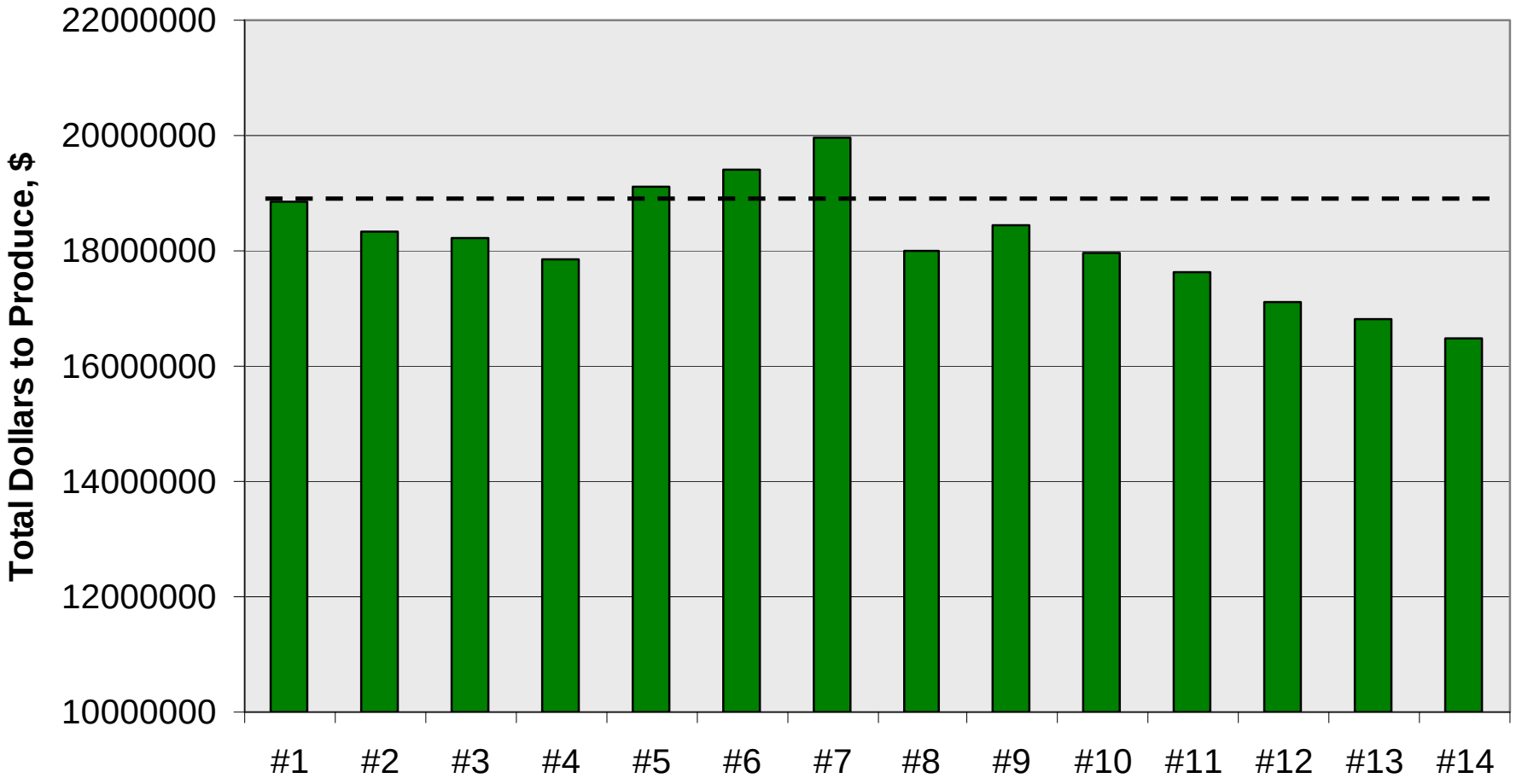
Total Prime Capacity at 7200 Hours Run Time



EFFECT OF VARIABLES ON TOTAL SCRAP COST
Scrap Produced x Cost



EFFECT OF VARIABLES ON PRIME PRODUCTION COST
38.88 Million lbs./Scrap Rate x Cost, $/lb.



OBSERVATIONS:

- Regrind addition causes increased production costs
- Without changing output rates, increasing the loadings of lower cost fillers has the greatest affect on cost but will likely have a significant affect on processability
- Removing the antimicrobial agent and reducing lubricant loading can reduce costs but the processor will pay with reduced output rates and loss of field performance
- Increasing output rates generates the most tangible gains in cost savings and capacity
- Combining increased output rates with lower scrap rates and higher filler loadings will result in the highest overall gains
- Engineered lubricant packages, even though they may be higher in price, can save the processor significant dollars

CONCLUSIONS:

- Reducing scrap rates may not have a significant effect on production costs, but reducing scrap does increase capacity and eliminates the need to find uses for scrap such as adding back into the formulation, which as shown can increase production costs.
- Moderate improvements in output rates can be the most important means to reducing overall production costs
- Output rate modification, in addition to providing immediate production cost improvement, is also the best solution in terms of burden of work for the processor, ease of implementation and effect on part performance.
- Optimized lubricant packages can give you the most flexibility for modifying your formulation

RECOMMENDATIONS:

- Depend on your suppliers to provide this type of justification for plant trials and evaluations
- Factor in the capacity gains in terms of equipment costs saved when calculating the total cost savings
- Take advantage of lower filler costs to reduce overall production costs
- Closely measure the effect of formulation changes on output rates and product properties….what looks like a lower priced solution may in fact lead to increased production costs
- The increasingly engineered nature of WPCs and field performance requirements will require some higher priced additives…using lubricants to offset these higher costs can work to the processors advantage
- Don’t settle for off-the-shelf solutions…make your supplier work for you!

Cost modeling is a service offered to all customers by Struktol Company of America.

Detailed explanations of the results generated for this presentation including the actual individual models are available upon request.

Thank you.